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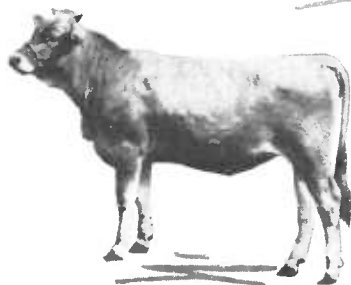
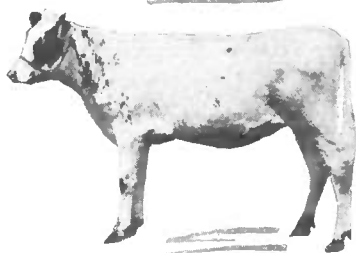
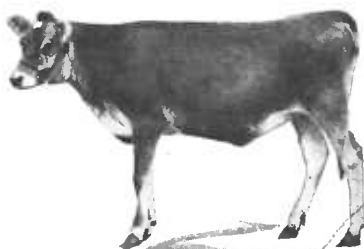
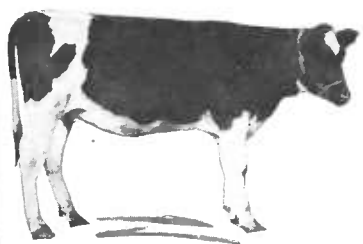
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U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1723

FEEDING, CARE, AND MANAGEMENT *of young* DAIRY STOCK



THE sure road to the development of a high-producing dairy herd is the raising of strong, healthy calves that have an inheritance for high milk and butterfat production.

Breed the cows in the herd to a registered dairy bull whose breeding is such as to insure the maximum probability of his transmitting to his progeny the hereditary factors that will determine a high level of production.

Give the pregnant cow and new-born calf the proper feeding and care.

Give the growing calf suitable feed and care so that it will develop properly.

Cleanliness is essential in all the details of feeding and care.

Feed whole milk for the first 2 to 4 weeks of the calf's life. After this age the calf can be gradually changed to fresh skim milk; or to any one of a number of milk products, or to a special calf meal. Calves make good use of milk or milk products up to 6 months or more of age.

Besides milk, the calf also needs a good quality of hay cured so as to retain its natural green color and most of its leaves, and a suitable grain mixture, to insure getting all the required nutrients, including minerals and vitamins.

Heifers over 6 months of age require an abundance of pasture in summer, and hay or hay and silage in winter, with sufficient grain in addition, to supply the nutrients for normal growth.

Dry, clean, well-bedded, and well-ventilated but not drafty quarters are required for dairy calves. Older heifers can be housed in a shed open to the south.

All ailments and diseases require prompt and proper treatment. Cleanliness is one of the best disease preventatives.

These and other points essential to raising good dairy stock are discussed in the following pages.

This bulletin supersedes Farmers' Bulletin 1336, Feeding, Care, and Management of Dairy Calves and Young Dairy Stock; Leaflet 20, Care of the Dairy Calf; and Leaflet 14, Raising the Dairy Heifer.

FEEDING, CARE, AND MANAGEMENT OF YOUNG DAIRY STOCK

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RAISING CALVES FOR HERD REPLACEMENTS

THE maintenance of a herd of high-producing dairy cows calls for the raising, for replacement purposes, of healthy, well-grown calves that have an inheritance for a high level of milk and butterfat production. To breed such calves healthy, high-producing cows should be mated with a carefully selected, registered dairy bull of good conformation, whose breeding is such as to insure the maximum probability for his transmitting the hereditary factors for high production to his offspring.

The feeding for proper growth and development of the dairy calf begins before it is born. The pregnant cow should be given sufficient feed so that she will be in fair to good flesh at calving time, and the ration fed should be adequate in vitamins and minerals. Cows fed rations greatly deficient in these important substances may give birth to weak, puny calves that are hard to raise. A strong, vigorous calf is more likely than a weak calf to respond normally to proper feeding and care, and to develop into a large-sized animal capable of producing up to its inherited capacity.

CARE OF THE FRESHENING COW

Cows freshen normally from about 270 to 290 days after breeding. The majority freshen within 275 to 285 days, with an average of about 280 days. Where accurate breeding records have been kept, the date of freshening can be calculated to within 1 to 10 days. This makes it possible to dry the cow off at the right time and give her the proper feeding and care during the dry period and at calving time.

Several days before the calf is due to arrive, separate the cow from the rest of the herd and place her in the calving quarters. During cold weather this should be a roomy, well-bedded box stall that has been thoroughly cleaned and disinfected. Keep the box stall clean and well-bedded, so that when the calf arrives it will be dropped in a clean, dry place. A small, well-grassed plot or pasture free from trash or manure and close to the barn makes a good calving place in summer.

The first indications of approaching calving are a pronounced swelling and enlarging of the vulva and a dropping away or sunken condition on either side of the tail setting. When these signs are noted, the cow should not be disturbed, but her condition should be observed from time to time. If everything is progressing normally, she will usually give birth to her calf without any assistance. Proper assistance should be given to the cow or to the calf if it is required. Such assistance may prevent the loss of a calf.

Detailed information regarding the feeding and management of the dry cow and care of the cow at calving time is contained in Farmers' Bulletin 1470, *Care and Management of Dairy Cows*.

CARE OF THE NEW-BORN CALF

Immediately after it arrives, the calf should be given attention. Remove any membrane or mucus from its mouth and nostrils. If the calf lies motionless and does not start breathing promptly, try to help start respiration by slapping the chest vigorously or by the alternate compression and relaxation of the chest.

The cow in normal condition is much concerned with the welfare of her calf, and usually begins to dry the calf at once by licking it vigorously. If she does not, or if the air is cold and damp, rub the calf dry with burlap or some other suitable material.

The new-born calf is very susceptible to disease germs. These may gain entrance through the navel or the digestive tract. To guard against navel infection, apply tincture of iodine to the navel at birth and dust with boric acid powder. If a long cord is attached to the navel, clip it off about 2 inches from the body before applying the iodine.

Be careful to keep the box stall clean and well-bedded while the calf remains with the cow, in order to lessen the danger of infection by contamination with filth.

A normal calf is able to stand shortly after birth, and within half an hour it may be nursing. If the cow's udder is soiled, there is danger of the calf being infected from this source. Wash the udder with warm water and soap, and rub dry at once with a clean cloth. Sometimes the calf is so weak that it must be held up to the cow's udder to help it get started to nurse. If it does not suck at first, milk a small stream of milk into its mouth. If the weak calf cannot be induced to suck by this method, try feeding it warm milk from its mother in a bottle, either with or without a nipple.

Be certain that the calf gets one or more good feeds of the first milk or colostrum. This milk is different in composition from normal milk (p. 10). It helps to clear out the digestive system and protects the new-born calf against infection from harmful bacteria gaining entrance through the digestive system. Experiments to determine the effect of withholding colostrum milk from calves show that where it is not fed, many calves die from the effects of infection from harmful bacteria.

If the cow and the calf are both progressing normally, the calf should not be left with the cow longer than 12 hours. When this period has elapsed it is best to remove the calf, because a calf which has been left too long with its dam is harder to teach to drink than one removed soon after birth. Also, the longer a calf is left with its dam the more the cow and calf will worry when they are separated.

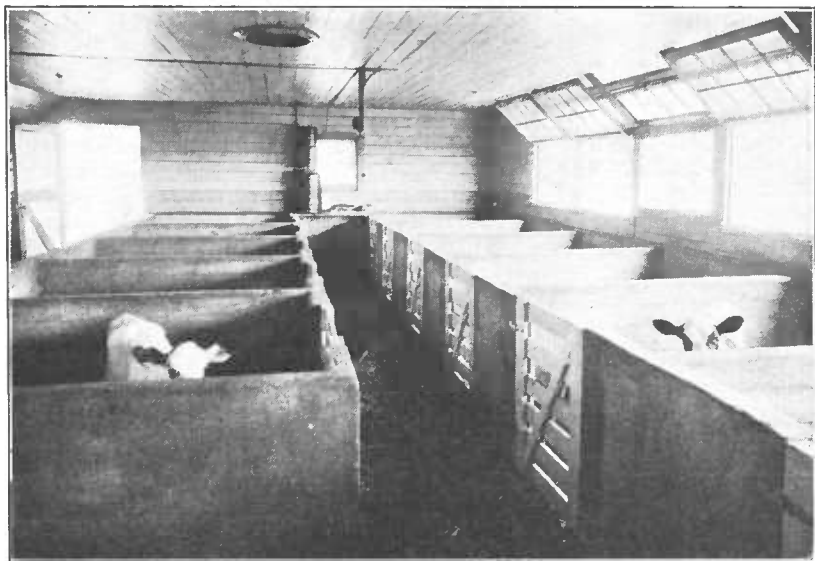


FIGURE 1.—Individual pens for young calves, Beltsville (Md.) Experiment Station.

QUARTERS FOR THE YOUNG CALF

When the calf is taken from its dam, place it in a small individual pen by itself where it cannot be jostled around or the navel injured by being sucked by other calves. A separate pen will also make it easier to feed and care for the calf and note its condition of health.

The pen should be light and well-ventilated but free from drafts and not too cold. It should be thoroughly cleaned and disinfected before the calf is placed in it, and kept well-bedded with dry material. Cold drafts and cold, damp pens are frequent causes of diarrhea, colds, and pneumonia.

To disinfect the calf pen, scrape off any manure remaining on the floor or walls, and scrub them thoroughly with hot water or an alkaline washing powder. When the floor and walls are clean, apply a suitable disinfectant to them with a spray pump, forcing the disinfectant into all small cracks and openings. Disinfectants and the disinfection of stables are discussed in detail in Farmers' Bulletin 954, *The Disinfection of Stables*.

In order to keep the calf from licking other calves or objects outside the pen, the sides should have no open spaces and be at least $3\frac{1}{2}$ feet high. This helps to protect the calf from disease germs and may also aid in preventing the spread of disease to other young calves. Figure 1 shows individual pens for young calves. A temporary individual pen is shown in figure 2.

The pen should be equipped with a small box for grain and a small slatted rack for hay, as the calf will be learning to eat these feeds before it is placed with other calves.

By the time the calf is 3 or 4 weeks old, its navel has healed, and it

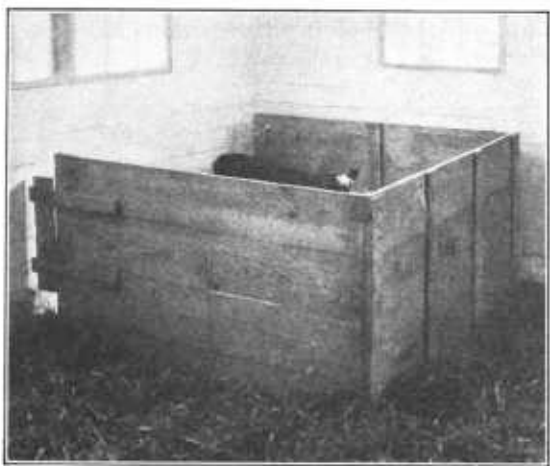


FIGURE 2.—Temporary pen, made from three solid wood panels, for the young calf.

has gained in strength and vigor. It can then be placed in a larger pen with other calves of about the same age. This pen should be equipped with stanchions (figs. 3 and 4), which permit each calf to feed individually without interference from other calves, and a slatted rack conveniently placed so that the calves can eat hay at any time when not confined in their stanchions. At this age the calves should also have access to a well-drained

lot or small pasture, where they can be turned out to get plenty of exercise and direct sunlight when it is not too cold or stormy.

The floor plan of a well-arranged maternity and calf barn is shown in figure 5.

CLEANLINESS IN FEEDING AND CARE

Calf diseases and many disturbances of the stomach and digestive system are caused by harmful bacteria which multiply in filth and dirt. Thorough cleanliness is absolutely essential in the successful raising of calves. This is equally true of the feed, pens, bedding, and the pails and other utensils.

All milk fed should be fresh and clean. All other feeds should also be fresh and wholesome. Keep the calf pens clean and well-bedded with dry material. Remove all discarded feed from the feed boxes every day. After each feeding thoroughly wash and scald or steam the pails, cans, and other utensils used in feeding milk or gruel to calves. If steaming equipment is not available, place the utensils on a drying rack in direct sunlight after they have been washed and scalded. This will help to keep them sweet and clean.

Milk from cows infected with a communicable disease such as tuberculosis and Bang's disease (infectious abortion), and skim milk, buttermilk, or whey from a creamery or cheese factory, should always

be pasteurized before being fed, because it is impossible to know whether such products are free from bacteria that cause disease.

Creameries and cheese factories usually pasteurize such products before making them available for feeding purposes. If they have not

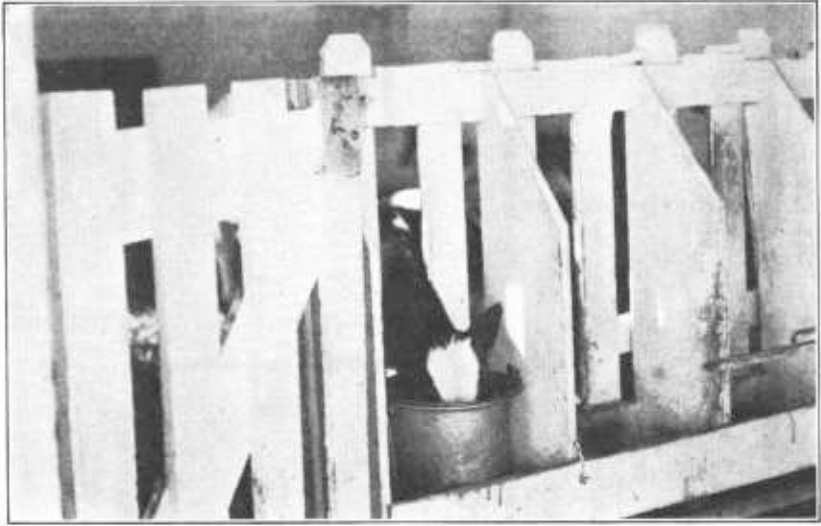


FIGURE 3.—Home-made calf stanchions and mangers.



FIGURE 4.—Steel calf stanchions and mangers.

been pasteurized, the necessary pasteurization can be accomplished on the farm by heating them to 150° F. and holding them at this temperature for 30 minutes, or by heating them to 180° F. and cooling immediately.

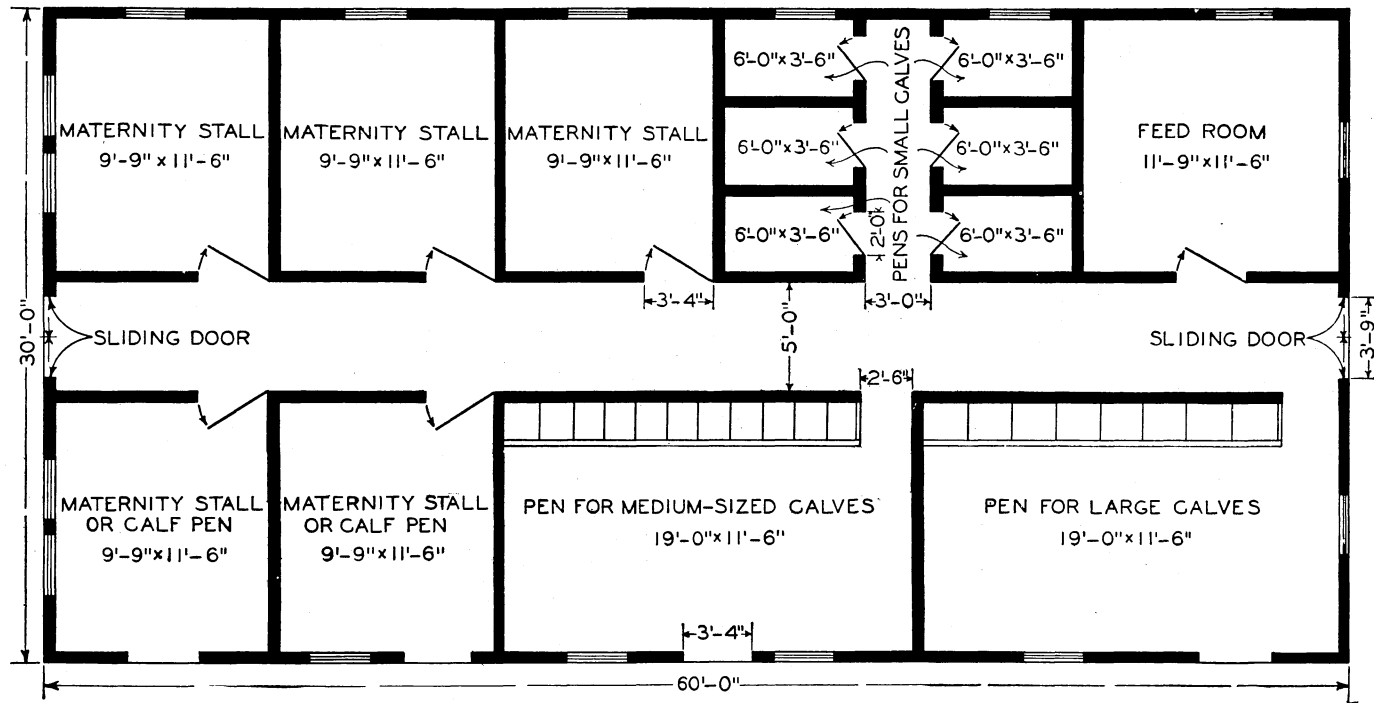


FIGURE 5.—Floor plan of a convenient maternity and calf barn.

TEACHING THE CALF TO DRINK

After the calf has been taken from its dam, do not feed it for at least 12 hours. It will then be hungry and can usually be taught to drink quite readily. A calf being taught to drink should always be handled gently.

For the first feeding place a quart of fresh warm milk from the dam in a clean pail. Hold the pail of milk on the floor in front of the calf, taking care to keep as far away from the calf as possible. The normal calf will nose around the pail, and will often begin to suck up or drink the milk of its own accord. If it does not, dip two fingers in the milk and place them in the calf's mouth. If the calf will not suck the fingers, raise its head, open its mouth, and pour in a teaspoonful of milk, taking care that the calf does not get any milk into its lungs, and then try again. When the calf has started to suck the fingers eagerly, draw the hand slowly down into the milk. Spread the fingers slightly and the calf will draw milk into its mouth between the fingers as it suks. After it gets several swallows remove the fingers. At this point the calf may continue to drink, or it may raise its head, and the foregoing procedure may have to be repeated several times.

Usually the calf will move around and butt the pail vigorously in its effort to get the milk. To restrain the calf and avoid spilled milk, it may be necessary to back the calf into a corner and straddle the calf before offering it milk (fig. 6). Then if the calf refuses to lower its head into the pail, the head can be forced down gently.

If the calf does not learn to drink at the first feeding, do not feed it again until it is hungry.



FIGURE 6.—Teaching the calf to drink.

FEEDING CALVES DURING THE FIRST 2 TO 4 WEEKS

The proper feeding of the dairy calf during the first month of its life is of the greatest importance. Since its digestive system is easily upset, the calf will thrive better at this time if it is fed sparingly rather

than too much. Also, precautions are necessary in hand-feeding that are not required when the calf takes its food in a natural manner.

In order to get a good start, the average strong, vigorous calf should be fed whole milk for at least 2 weeks; then the whole milk may be gradually replaced by fresh skim milk, other milk products, or specially prepared calf meals. If the calf is weak, or if it is especially valuable, feed whole milk 3 or 4 weeks before making any change.

During the first week feed fresh, warm milk from the calf's dam. Afterwards mixed milk from the herd can be used.

If the calf is weak, it may be desirable to feed small quantities of milk three times a day for a week or two, after which twice a day will be sufficient. Strong calves will usually do about as well if fed only twice a day from the start.

QUANTITY OF WHOLE MILK TO FEED

The quantity of whole milk to feed will depend upon the size and condition of the calf. In attempting to grow a good calf, too often the tendency is to feed too much milk at the start. As a consequence the calf gets indigestion and scours, and does not thrive as well as if it had received a smaller quantity. Never feed the strong, vigorous calf more than 1 pound of milk per day for each 10 pounds of live weight, during the first 7 days. Feed small, sick, or weak calves smaller quantities, according to their condition.

Data on the birth weight of dairy calves collected by a number of agricultural experiment stations throughout the United States indicate that the average weight at birth of calves of the principal dairy breeds is approximately as follows: Jerseys, 55 pounds; Guernseys, 65; Ayrshires, 70; Holsteins, 90; and Brown Swiss, 95. The smallest calves weigh considerably less and the largest calves considerably more than these average figures. Male calves weigh a little more than female calves, and purebred Holstein and Brown Swiss calves are heavier on an average than grade calves of these breeds.

The following quantities of milk per day will be sufficient at the start for average-sized, vigorous calves of the different breeds:

	<i>Pounds</i>
Jersey	5
Guernsey	6
Ayrshire	7
Holstein	8
Brown Swiss	8

Large and vigorous calves may be safely fed 1 or 2 pounds per day more than the quantities indicated. Small calves and calves that are weak or sickly should receive smaller quantities, according to their condition. If it is necessary to reduce greatly the quantity of milk fed, the calf may not get sufficient liquid to supply its needs for water. In such cases, add enough warm water to make up for the reduction in the quantity of milk.

To avoid indigestion and scours, feed the calf at regular hours. Carefully regulate the quantity of milk and feed it at a temperature of 90° to 100° F. Use a scale and weigh the milk at each feeding (fig. 7). If a scale is not available, use a pint or quart measure and measure the quantity very closely. For feeding purposes, consider 1 pint as 1 pound, and 1 quart as 2 pounds.

Too rich milk may give the calf indigestion and scours. If the milk tests more than 4 percent butterfat, dilute it with a little warm water or skim milk at each feeding.

ADDING LIMEWATER TO MILK

Until the calf is 3 or 4 weeks old, the addition of one half pint of limewater to the whole milk at each feeding appears to be beneficial. The hand-fed calf drinks milk rapidly, and limewater will help prevent the milk from forming into a hard curd that cannot be readily digested by weak or sickly calves.

Limewater may be made from either unslaked lime (lump lime) or commercial hydrated lime (common plaster lime, usually sold in paper bags). To make limewater from unslaked lime, place a lump about the size of an egg in the bottom of a pail of water. When this has slaked, stir vigorously. When using commercial hydrated lime, stir 2 ounces or so into a bucket of water and mix thoroughly several times at short intervals. In either case allow the lime to settle and use only the clear solution. When this supply is gone, use fresh lime in making up a new batch.

METHOD OF FEEDING AT BELTSVILLE

A large number of Jersey and Holstein calves are raised each year at the experiment station at Beltsville, Md. They are taken from their dams when about 12 hours old and are fed twice a day from the start. Whole milk is fed for the first 30 days, and then a change is gradually made to skim-milk feeding. The quantities of milk fed are as follows:

Jersey calves receive $2\frac{1}{2}$ pounds of whole milk and one half pint of limewater per feed for the first 10 days; 3 pounds of whole milk and one half pint of limewater per feed for the second 10 days; and 4 pounds of whole milk and one half pint of limewater per feed for the third 10 days.

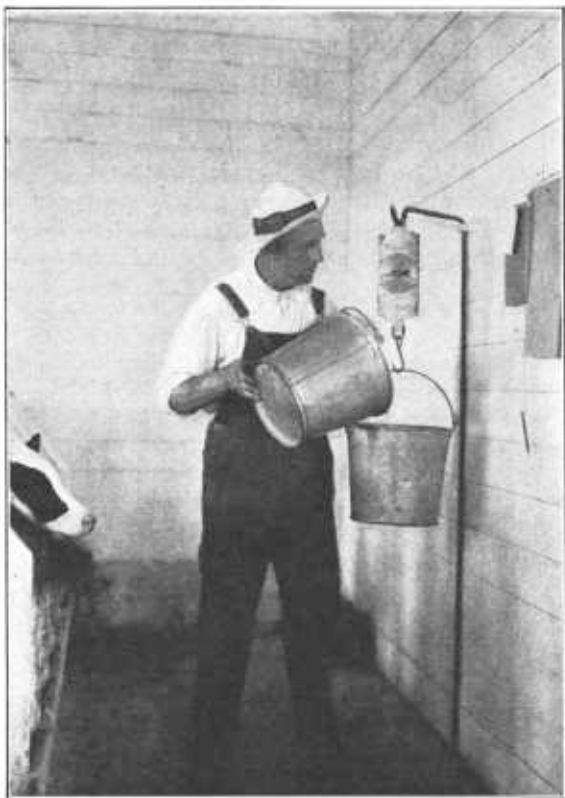


FIGURE 7.—Weighing milk for the calf.

Holstein calves receive 4 pounds of whole milk and one half pint of limewater per feed for the first 10 days; 5 pounds of whole milk and one half pint of limewater per feed for the second 10 days; and 6 pounds of whole milk and one half pint of limewater per feed for the third 10 days.

Calves that are weak or sickly are fed considerably smaller quantities of milk until their condition improves and they are able to digest normal quantities.

FEEDING CALVES FROM 1 TO 6 MONTHS OF AGE

DIFFERENT METHODS OF FEEDING

After the calf has received a good start on whole milk, it will grow and develop satisfactorily on a number of different feeds if their quality is good and feeding conditions are carefully controlled.

A few breeders of dairy cattle continue whole-milk feeding, but whole milk is usually too valuable to feed to calves of this age. Calves do nearly as well on fresh skim milk, and where it is available most calves are raised on this feed. If fresh skim milk is not available, calves can be raised satisfactorily on fresh buttermilk, fresh whey, dried or powdered skim milk, dried buttermilk, and condensed or semisolid buttermilk. With careful feeding the use of any of these products, except possibly whey, will get results nearly equal to those obtained from fresh skim milk. The average chemical composition of normal whole milk, colostrum milk, skim milk, buttermilk, and whey are given in table 1. The calf requires hay of good quality, a suitable grain mixture, and a plentiful supply of pure water at an early age to supplement these feeds.

TABLE 1.—Average composition of normal whole milk, colostrum milk, skim milk, buttermilk, and whey¹

Product	Water	Mineral matter	Protein	Sugar or carbohydrates	Fat
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Normal whole milk.....	87.0	0.7	3.3	5.0	4.0
Colostrum milk.....	74.5	1.6	17.6	2.7	3.6
Skim milk.....	90.5	.7	3.4	5.1	.3
Buttermilk.....	91.0	.8	3.5	4.2	.5
Whey.....	93.4	.7	.8	4.8	.3

¹ Missouri Research Bulletin 35, A Study of the Birth Weight of Calves.

Where milk or milk products are not too high in cost it is best to continue feeding them until the calf is about 6 months of age. At this time the calf should be eating large enough quantities of other feeds so that its growth will not be retarded to any appreciable extent.

When the cost of feeding milk or milk products is excessive, they may be gradually discontinued after the calf is 3 months old. Usually such calves will not gain so rapidly at this time as calves fed milk for 6 months.

If the young calf is given a specially prepared calf meal, the use of milk in any form can be gradually discontinued beginning with the third or fourth week, or as soon as the calf starts eating calf meal. The better grades of calf meal contain some form of animal product. For a time calves fed calf meal will not gain so fast or be so thrifty-looking as those fed milk products.

CONTINUING TO FEED WHOLE MILK

On farms where no skim milk or other milk product is available and whole milk is too valuable to feed large calves, after the third or fourth week the calf should be given whole milk in gradually decreasing quantities and be given increasing quantities of good hay and a specially prepared calf meal, fed either dry or as a gruel, until at 6 or 7 weeks of age the calf is getting no milk. The quantity of whole milk to use under this method of feeding is discussed under Specially Prepared Calf Meals.

Dairy calves to be disposed of for veal usually continue to receive whole milk until slaughtered. This is taken up under Feeding Dairy Calves for Veal.

FRESH SKIM MILK

If the calf is doing well, gradually substitute fresh skim milk for whole milk when the animal is 2 to 4 weeks old. Take at least 10 days to make the change, substituting skim milk for whole milk at the rate of about 1 pound a day. Do not increase the total quantity of milk fed while this change is being made. If the calf has scours (diarrhea) the milk is not being properly digested. Delay any further substitution of skim milk for whole milk until this condition disappears. It may be necessary to give the calf a purgative and reduce the quantity of milk fed. The treatment for scours is taken up under Scours from Indigestion.

Feed fresh warm skim milk direct from the separator if possible. If the skim milk is not fed soon after being separated, warm it to about 95° F. before feeding. Feeding dirty milk, or milk alternately sweet and sour or warm and cold, may bring on indigestion and scours. If the feeding is carefully supervised, milk that is uniformly cold or sour can be fed successfully after the calf is 2 to 3 months of age. However, some calves may have a tendency to scour on such milk, and it is best to make a practice of feeding only warm, sweet skim milk. In feeding skim milk, take care to remove the foam as this sometimes causes digestive trouble and bloating.

After changing from whole milk to skim milk, increase the quantity of skim milk fed by 1 pound daily every week or by 2 pounds daily every 2 weeks, until the calf is getting at least 14 pounds a day. After this time the quantity fed depends largely on the quantity of skim milk available. Good calves can be raised on a maximum of 14 pounds of skim milk a day, although some calves can make use of as much as 18 to 20 pounds daily. Skim-milk feeding can be successfully terminated when the calf is 4 months old, if the proper supplements are fed. However, the calf will not grow so rapidly as when skim-milk feeding is continued for a longer period. If skim milk is available, it should be fed until the calf is 6 months old. Where especially good growth and development are desired, skim milk can be fed to advantage until the calf is 8 to 10 months old.

FRESH BUTTERMILK AND FRESH WHEY

Buttermilk or whey to be suitable for calves should be strictly fresh, and should not be diluted by wash water or condensed steam. They should also be pasteurized, and hauled to the farm and fed while still fresh and wholesome. If the above conditions are not met, these feeds will not prove satisfactory for dairy calves.

Fresh buttermilk has practically the same composition as fresh skim milk, but is higher in acid content except possibly when sweet-cream butter is manufactured. If fresh buttermilk is to be fed, do not change from whole milk to fresh buttermilk until the calf is 4 weeks old. Then follow the directions as in feeding fresh skim milk, both as regards quantity and methods of feeding.

As whey lacks most of the protein contained in skim milk, the grain mixture fed with whey should contain more protein than one fed with skim milk (p. 14). Like fresh buttermilk, fresh whey has a higher acid content than fresh skim milk. Do not change from whole milk to whey until the calf is 5 or 6 weeks old; then proceed as in feeding fresh skim milk. While a fair rate of growth can be obtained by feeding fresh whey, the calf will not gain as rapidly as on fresh buttermilk or fresh skim milk under the same conditions of feeding. The addition of a little whole milk or skim milk to whey will make it a better feed.

Both fresh buttermilk and fresh whey are likely to be a little more laxative than fresh skim milk, and more care should be exercised when changing to these feeds than when changing from whole milk to fresh skim milk. In order to avoid digestive disturbances, these feeds should be uniform in quality, and the quantity fed should be increased gradually.

DRIED SKIM MILK, DRIED BUTTERMILK, AND CONDENSED OR SEMISOLID BUTTERMILK

Dried skim milk and dried buttermilk are manufactured from the fresh products by removing most of the water, using heat and either the spray process or the drum or roller process. Feeding trials at a number of agricultural experiment stations show that calves will make satisfactory growth on these milk products, and that products dried by either process may be used. These feeds have a low moisture content. They are shipped in either paper-lined barrels or bags and will keep indefinitely if stored in a dry place.

In the production of condensed or semisolid buttermilk, part of the water is removed, leaving the material in a semisolid or heavy liquid form. Calves do nearly as well on semisolid buttermilk as on dried buttermilk. Condensed buttermilk is shipped in sealed barrels or cans, and will keep indefinitely without loss from mold if an even layer is removed from the entire surface each day.

The calf may be fed dried skim milk reconstituted to the approximate composition of fresh skim milk, beginning at 2 to 4 weeks of age. The feeding of reconstituted buttermilk, made from either dried or condensed buttermilk should be delayed until the calf is 4 weeks old. Gradually change from feeding whole milk to the reconstituted milk product in the same way and using the same quantities as recommended for fresh skim milk (p. 11). The change from whole milk to dried skim milk will have about the same effect on the calf as the change from whole milk to fresh skim milk. Dried and semisolid buttermilk are likely to be a little more laxative than fresh or dried skim milk, and more care should be exercised when changing from whole milk to reconstituted buttermilk than when changing from whole milk to skim milk.

To prepare the dried skim milk or dried buttermilk for feeding the young calf, mix 1 part of the dried product to a smooth paste with an equal part by weight of warm water. When the lumps have all been broken up, add 8 more parts by weight of warm water and stir

thoroughly. To prepare the condensed buttermilk for feeding, add 3 parts by weight of warm water and stir until well mixed. For best results, mix with the same proportion of water from day to day and feed at a temperature of about 95° F. Mix only enough at one time for one feeding.

If these products do not cost too much, feed the same quantities as for fresh skim milk until the calf is 4 to 6 months old. If the cost of such products is too high, the amount fed per day can be gradually reduced, beginning at 6 or 7 weeks of age, and the calf fed a grain mixture containing 25 percent of dried skim milk or dried buttermilk until it is 3 to 4 months old.

SPECIALLY PREPARED CALF MEALS

If skim milk or other milk products are scarce or high priced, whole milk may be gradually replaced by a specially prepared calf meal. Although this is not quite as satisfactory as feeding fresh or dried skim milk, the results will be fairly satisfactory if a good calf meal is properly fed.

Several ready-mixed calf meals are on the market. The best ones contain an animal product, preferably some sort of dried milk. Satisfactory calf meals can be mixed at home if the necessary ingredients can be obtained.

The following mixture has been devised at the Beltsville Experiment Station where it has given satisfactory results:

Fifty parts of finely ground corn, 15 parts of linseed meal, 15 parts of finely ground rolled oats, 10 parts of dried blood flour, 10 parts of dried skim milk, and 1 part of salt. The composition of this meal is not materially different from that of other calf meals in satisfactory use at several experiment stations.

Formerly, calf meals were fed wet in the form of a gruel. This method of feeding requires more labor and greater precautions to prevent scours than is required for skim milk. Recent experiments have shown that calves receiving dry calf meal can be raised with less labor and trouble than when the meal is fed wet.

Specially prepared calf meals are milk substitutes. However, they cannot take the place of milk during the first few weeks of the calf's life, as the calf must have milk at this time in order to thrive. While some experiments have shown that calves can be raised on calf meals with no milk after 30 days of age, better results will be obtained if the calf is fed limited quantities of milk for a longer period.

The following directions for feeding calf meal apply to both commercial meals and those mixed at home, and are made on the basis of feeding limited quantities of whole milk, in addition to meal, until the calf is 50 or 60 days of age, depending on the breed.

Feed Holstein and Brown Swiss calves 8 to 10 pounds of whole milk a day until they are 10 days old, then 8 pounds a day for the next 10 days, then 6 pounds for the next 10 days, then 4 pounds for 10 days, and so on until at 50 days of age the calf will be getting no milk.

Feed Jerseys 5, Guernseys 6, and Ayrshires 7 pounds of whole milk a day for the first 10 days, then 8 pounds for the next 20 days, then 6 pounds for 10 days, and so on until at 60 days of age the calf will be getting no milk.

When the calf is 2 or 3 weeks old, start feeding it small quantities of a grain mixture consisting of whole or coarsely ground grain and a good quality of hay.

Begin the feeding of the calf meal when the calf is 20 days old. If the meal is fed dry, give the calf all it will eat up to 2 pounds a day, adding 5 or 10 percent by weight of whole corn to the meal to prevent too rapid eating.

If the meal is fed wet, mix it with six times its weight of warm water and start with about 0.4 pound of dry meal a day. Increase the amount by about 0.2 pound dry weight every 4 days, so that at the end of 50 or 60 days the calf will be getting 2 pounds of meal a day.

When the calf is 3 months old the dry or wet calf meal may be discontinued gradually, and the quantity of grain increased accordingly.

By following this method of feeding, only about 300 pounds of whole milk will be required to raise a calf. Experience has shown that health cannot be maintained and satisfactory growth made on much less than this quantity.

HAY, GRAIN, AND SILAGE

After the calf is 2 to 3 weeks old, it requires other feeds in addition to milk in order to grow and develop properly. At the beginning of the third week, give it small quantities of hay and grain. Feed the most palatable hay on hand. Early cut clover, alfalfa, or mixed hay cured so as to retain its green color and most of its leaves is high in vitamins and assimilable minerals, and is best suited for calves. Place the hay in a rack where the calf can reach the hay but cannot soil it. Young calves fed alfalfa hay that is extra leafy may eat enough to cause scours. It is better to limit the quantity of such hay fed until the calves have become accustomed to it.

The grain mixture used should be palatable, have no bad effect on the digestive system, and supply the required nutrients. Home-grown grains such as corn and oats and purchased feeds such as wheat bran and linseed meal are good calf feeds. Young calves show a preference for whole grains and will gain as fast or a little faster on whole grain than they would on ground grain. When teaching the calf to eat grain, place a small handful of coarsely ground corn or mixed corn and oats in the bottom of the pail after the calf has finished drinking its milk. After the calf has learned to eat grain readily, feed whole or coarsely ground grain to balance the ration. Feed older calves grain that has been medium or coarsely ground. The following grain mixtures are suitable for calves.

MIXTURES CONTAINING 10 TO 12 PERCENT TOTAL PROTEIN

For calves fed milk or milk products other than whey and for weaned calves and heifers on good pasture or receiving legume hay alone:

A	B	C	D
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Oats alone.	Corn..... 10	Corn..... 30	Corn..... 30
	Oats..... 10	Wheat bran.. 10	Oats..... 10
			Wheat bran.. 10

MIXTURES CONTAINING 14 TO 16 PERCENT TOTAL PROTEIN

For calves fed whey or a calf meal and for weaned calves and heifers receiving a legume hay and silage or mixed hay alone:

E	F	G
<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Corn..... 30	Corn..... 30	Corn..... 30
Oats..... 10	Wheat bran..... 10	Oats..... 10
Linseed meal..... 10	Linseed meal..... 10	Wheat bran..... 10
		Linseed meal..... 10

MIXTURES CONTAINING 18 TO 20 PERCENT TOTAL PROTEIN

For weaned calves and heifers receiving mixed hay and silage or grass hay alone or with silage:

H		I		J	
	Pounds		Pounds		Pounds
Corn-----	10	Corn-----	20	Corn-----	10
Oats-----	20	Wheat bran-----	10	Oats-----	10
Linseed meal-----	10	Linseed meal-----	10	Wheat bran-----	10
				Linseed meal-----	10

In these grain rations, barley, kafir, or hominy feed may replace part or all of the corn. Calves over 6 months of age may be fed cottonseed meal instead of linseed meal.

A calf 2 weeks old will eat only a small handful of grain per day. Increase the amount gradually until the calf gets about half a pound daily at 4 weeks of age, a pound at 6 weeks, 1½ pounds at 8 weeks, and 2 pounds at 10 weeks to 3 months of age. If the calf is given liberal quantities of some milk product up to the age of 6 months, 2 pounds of grain per day may be sufficient to keep it growing well. If the use of milk products is discontinued before 6 months, it will be necessary to feed 3 or even 4 pounds of grain a day (including any calf meal).

Silage is not a satisfactory feed for the young calf, as its addition to a ration of milk, hay, and grain may cause digestive disturbances and scours. However, it makes a good supplemental feed after the calf has reached 3 months of age. Silage should be fed only in limited quantities in addition to hay of good quality, as it is desirable that the calf eat as much hay as possible. One to two pounds of silage per day is enough for the 3-month-old calf. Gradually increase the quantity at the rate of 1 pound a day for each month of increase in the calf's age. Take care not to feed any moldy or frozen silage, and remove any uneaten silage from the manger each day.

PASTURE

Fall and early winter calves will make good growth on pasture the following spring and summer if the pasturage is supplemented by skim milk and grain, or grain alone when the calves have reached 4 to 6 months of age. Spring calves will not be old enough to make extensive use of pasture until late summer and fall, when pasturage is often poor. For this reason it is best to keep spring and summer calves off pasture, except to exercise, until the following season. Besides, the addition of green grass to the ration of milk and grain may cause digestive disturbance and scours in calves under 2 months of age. Young calves will do better in hot weather when kept in well-ventilated, shady quarters during the day than when allowed to roam in a pasture or open lot in the sun.

WATER

The importance of water for young calves is not always fully realized. The calf should be supplied regularly with fresh, pure water. It should not be permitted to suffer from a lack of water, especially during warm weather, or when it is being fed a limited quantity of milk. Soon after the calf has learned to drink, it can be readily induced to drink water from its pail immediately after finishing its milk. At first the calf should be offered water warmed to about body

temperature. Calves old enough to run together should have a supply of drinking water available in a conveniently located tank or water trough.

The extent to which a lack of water may affect the growth and development of calves is indicated by an experiment conducted at the Wisconsin Experiment Station during warm weather. Two groups of calves each received 14 pounds of skim milk per day per calf and all the hay and grain they would eat. The calves in the group given water consumed somewhat more water than milk. They also ate twice as much hay, nearly one third more grain, and gained 0.44 pound more per day than the calves in the group receiving no water.

MINERALS

Salt should be provided as soon as the calf is old enough to eat hay and grain. One pound of salt may be added to each 100 pounds of the grain mixture or the calf meal. Salt should also be placed in a conveniently located box where the calf can have access to it as desired.

The ration of the calf receiving a well-cured legume hay, grass hay, or mixed legume and grass hay, and a suitable grain mixture, along with salt, will usually be adequate in minerals. Experiments at a number of agricultural experiment stations have shown that under these conditions no benefit is derived from the addition of supplemental minerals to the growing animal's ration.

However, if hays of poor quality are fed, there may be a shortage of calcium in the ration. Also, in localities where there is a shortage of phosphorus in the soil, rations consisting of home-grown feeds may be deficient in this mineral.

Wheat bran and linseed meal are high in phosphorus, and the inclusion of one of these feeds in the grain mixture will take care of any phosphorus deficiency. Bone meal is a source of both calcium and phosphorus, and is a suitable mineral supplement for use where these minerals are deficient in the ration. A special grade of feeding bone meal or poultry bone meal is suitable for this purpose. The bone meal can be added to the grain mixture at the rate of 1 pound to each 100 pounds of grain, or it can be mixed with salt at the rate of 3 or 4 parts of bone meal to 1 part of salt and placed in a box alongside the salt box where the calves and heifers can have access to it as desired. Many commercial dairy feeds and calf meals contain from 1 to 2 percent of bone meal.

In regions where calves are born with big neck or goiter, iodine may be deficient in the ration. However, the supplemental use of iodine in the ration is necessary only in feeding pregnant cows and heifers, so that the calf will be normal at birth. Iodine may be given effectively by mixing with the feed of the pregnant cow once each week a tablespoonful of a 5-percent solution of potassium or sodium iodide.

VITAMINS

Vitamins are certain substances other than protein, carbohydrates, fats, and minerals that occur in minute quantities in natural food substances and are essential to the life and health of animals. Those vitamins studied have been named A, B, C, D, E, and G. Vitamin B is sometimes called B₁ or F, and vitamin G is sometimes called B₂. Both these vitamins were formerly called B.

Of these six vitamins, A is the one most likely to be deficient in the calf's ration, according to the information so far obtained. Vitamin A has to do with growth and resistance to infection. Carotin, one of the yellow pigments of plants from which vitamin A is formed in the animal body, occurs in close association with the green coloring matter of pasture plants and other green forage, and also with the green coloring matter of cured roughages. In carrots and yellow corn it occurs in dissociation from the green color. The vitamin A content of yellow corn, however, is very low in comparison to that of carrots and green roughages. As a rule, the greener the color of the roughage the greater its content of carotin.

Vitamin D or some unidentified property of pasture grass, or of other green forage, or of hay cured with much of its natural green color, is useful in promoting the assimilation of calcium or lime, and the retention of calcium in the body.

Feeding experiments with dairy cattle at the Beltsville Experiment Station show that cows fed for extended periods on a ration deficient in vitamin A give birth to weak, dead, or immature calves; that the vitamin A content of milk produced by cows on such rations is also greatly reduced; and that calves fed the milk from cows that have received a vitamin A deficient ration for some time will cease to grow and will soon die if fed a poor grade of hay low in vitamin A, but if given supplementary feeds rich in vitamin A or carotin they will survive. Whether this is due entirely to a deficiency of vitamin A has not been determined definitely.

In these experiments it was found possible to prevent this condition, or bring the calf back to normal health and rate of gain in body weight by the addition of 20 cc (a little more than 1 tablespoonful) of cod-liver oil daily to the ration.

When the dairy calf's ration is deficient in vitamin D, sufficient calcium or lime may not be deposited in the bones, and a rachitic condition known as rickets may develop, especially during the winter months. Experimental work has also shown cod-liver oil to be effective in preventing or curing this condition.

In the light of present knowledge it appears that when a normal healthy calf is fed a ration adequate in quantity and in the vitamins A and D, no benefit will be derived from cod-liver oil. Since winter milk does not ordinarily contain as much of vitamins A and D as summer milk, and because the young calf consumes hay in very limited quantities, it may be desirable to give cod-liver oil to calves up to 2 or 3 months of age during the winter feeding period, if the calf does not seem to be thrifty or to be gaining as well as it should.

In feeding the calf, provide as much of vitamins A and D in the ration as possible by feeding it milk in summer from cows receiving pasture or green cut feed, and in winter, early cut hay cured so as to retain its natural green color and most of its leaves. Beginning at an early age, feed the calf all the hay of this quality it will eat in addition to the milk.

FEEDING HEIFERS FROM 6 TO 12 MONTHS OF AGE

By the time the calf has reached 6 months of age, the feeding of skim milk or specially prepared calf meals has usually been discontinued. The heifer should have an abundance of other feeds so that she will continue to gain normally. Supply plenty of roughage at all times in the form of good pasture in summer, and hay and silage in winter.

Feed enough grain in addition so that the heifer will remain in a good state of flesh.

In summer green pastures furnish well-balanced feed for growth. Usually green pasture plants are high in protein and minerals. Furthermore, the minerals in green pasture plants are more easily and completely taken up by the body than are the minerals in any other feeds. A heifer from 6 to 12 months of age may require a little grain in addition to pasture, even when the pasture is good. Early in the spring, when she is first put on pasture, and late in the summer, when pastures are short, some additional roughage in the form of hay or silage will also be required.

During the winter feeding season, give the 6- to 12-month-old heifer all the good hay she will eat, 5 to 15 pounds of silage per day, if available, and enough grain to keep her growing normally.

Evidence is accumulating from experiments completed, and others underway, to indicate that a good rate of growth can be made on a ration consisting entirely of roughage, starting at as early an age as 6 months, when the roughage fed is of good quality.

In feeding grain, a safe rule to follow is to feed the heifer receiving roughage of only fair or average quality about one half pound of grain per day for each 100 pounds of body weight. If the hay is a legume of good quality, feed less grain. A grain mixture containing 10 to 12 percent of total protein will be suitable for heifers on good pasture or receiving legume roughages, for example—alfalfa, clover, vetch, cowpea, field-pea, and soybean hays. If some of the roughage is in the form of nonlegumes—for example, prairie hay, timothy hay, corn stover or corn silage—the grain mixture should contain 14 to 16 percent of total protein. When the roughage consists entirely of nonlegumes, excepting grasses cut at an immature stage of growth, a grain mixture containing 18 to 20 percent of total protein will be necessary to furnish sufficient protein in the ration. Suitable grain mixtures are given on pages 14 and 15.

When the heifer receives green pasture, hay cured with a green color, and wheat bran as part of the grain ration, her requirements for minerals and vitamins will be provided for if she gets enough feed.

FEEDING HEIFERS FROM 1 TO 2 YEARS OF AGE

A heifer from 1 to 2 years old needs the same kind of feed and about the same kind of care as a heifer 6 to 12 months old, but if fed plenty of roughage of good quality, can make good growth with less grain.

When on abundant good pasture (fig. 8), additional feed will not be necessary for good growth. It will be necessary to supplement early spring and short summer pastures by feeding hay or silage (fig. 9), and in some cases a little grain.

During the winter feeding period, give her all the good hay she will eat. If silage is available, and relatively cheaper than hay, feed as much as 15 to 25 pounds per day. In addition, feed her grain according to her condition. If a good-quality alfalfa hay and corn silage are fed liberally, the heifer will make good growth with little or no grain. If the hay is partly nonlegume, or if the roughage is low in quality, more grain will be required. Usually from one third to one half of a pound of grain daily for each 100 pounds of body weight will be sufficient. The heifer should be in good flesh at calving time, but not excessively fat.

EFFECT OF DIFFERENT METHODS OF FEEDING ON THE GROWTH OF DAIRY HEIFERS

The effects of different methods of feeding on the growth of dairy heifers is shown in table 2, which gives the average live weights by



FIGURE 8.—Pastures should furnish shade and water as well as good grazing.



FIGURE 9.—Heifers on short pasture need supplementary feed.

months from birth to 2 years of age, for Holstein heifers raised at the Federal dairy experiment stations at Huntley, Mont., and Ardmore, S.Dak., and for both Holstein and Jersey heifers raised at Beltsville, Md.

TABLE 2.—Average body weights by months from birth to 2 years of age, for Holstein heifers at the Huntley (Mont.), Ardmore (S.Dak.), and Beltsville (Md.) Experiment Stations, and for Jersey heifers at the Beltsville Station

Age	Holstein			Jersey
	Huntley ¹	Ardmore ²	Beltsville ³	Beltsville ⁴
	Pounds	Pounds	Pounds	Pounds
At birth.....	87	90	97	51
1 month.....	126	132	121	72
2 months.....	174	184	155	92
3 months.....	231	238	197	128
4 months.....	294	294	253	168
5 months.....	361	342	303	211
6 months.....	425	403	360	257
7 months.....	488	449	407	299
8 months.....	544	485	460	335
9 months.....	594	515	507	372
10 months.....	634	537	553	404
11 months.....	680	560	586	436
12 months.....	721	590	627	466
13 months.....	750	628	662	490
14 months.....	786	659	708	515
15 months.....	807	689	745	538
16 months.....	842	707	777	562
17 months.....	870	730	812	583
18 months.....	905	752	840	603
19 months.....	936	787	881	627
20 months.....	969	824	912	644
21 months.....	990	860	944	666
22 months.....	1,016	894	982	693
23 months.....	1,050	934	1,016	722
24 months.....	1,071	973	1,057	743

¹ Average of 16 heifers.

² Average of 17 heifers.

³ Average of 27 heifers.

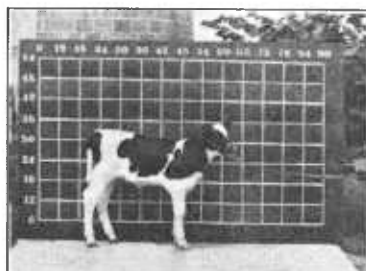
⁴ Average of 35 heifers.

At Huntley, Mont., the heifers were fed whole milk for about 1 month, and then skim milk, together with grain and alfalfa hay, until they were 9 months old. After the age of 9 months, they received alfalfa hay and corn silage without grain. They were also on irrigated pasture about 2 months during the second year.

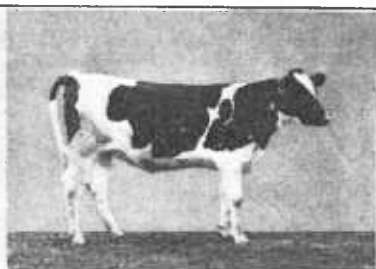
At Ardmore, S.Dak., the heifers were fed whole milk about 1 month, and then skim milk, together with grain, alfalfa hay, and corn silage, until they were 6 months old. After the sixth month of age, they received hay, corn silage, and grain in winter, and were on native unirrigated pasture in summer without any other feed, during both the first and second years. The hay fed was about two thirds alfalfa and one third barley, millet, brome grass and sweetclover hays combined. The grain consisted entirely of a mixture of home-grown grains. The quantity of grain fed did not exceed 2 pounds per head per day, except that some of the heifers received extra grain during one winter when there was a shortage of roughage feeds.

At Beltsville, the method of feeding used for both Holstein and Jersey heifers was as follows: They received whole milk until they were about 1 month of age; then had skim milk in moderate quantities, together with grain, alfalfa hay, and corn silage, until they were 6 months old. After the sixth month they received grain, hay, and corn silage. During the summer of the second year, most of the heifers were on pasture and also had grain, except for a short time when the pasture was at its best. The rate of grain feeding was increased to a maximum of about 4 pounds per day for Holstein heifers and 3 pounds per day for Jersey heifers.

The rate of growth and general appearance of a Holstein heifer and a Jersey heifer from 1 month to 2 years of age and at maturity, raised



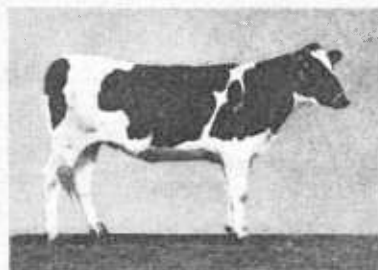
Age 1 Month
Weight 125 Pounds



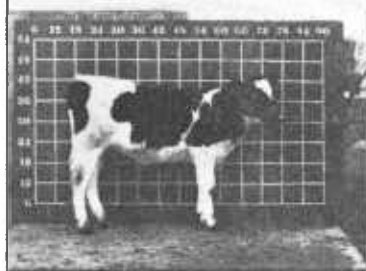
Age 1 Year
Weight 654 Pounds



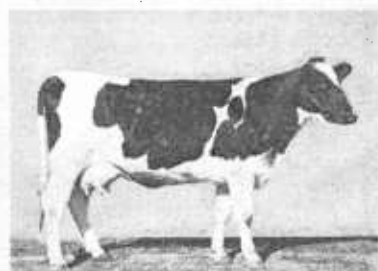
Age 3 Months
Weight 210 Pounds



Age 1 Year 7 Months
Weight 874 Pounds



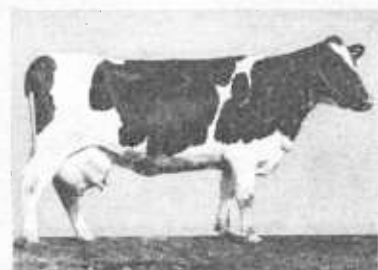
Age 6 Months
Weight 360 Pounds



Age 2 Years 4 Months
Weight 1,100 Pounds

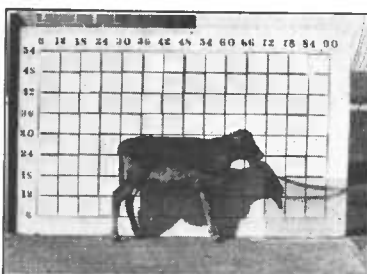


Age 9 Months
Weight 499 Pounds



Age 5 Years 7 Months
Weight 1,470 Pounds

FIGURE 10.—Pictorial record of the growth of a Holstein female at the ages stated, in the experimental breeding herd of the Bureau of Dairy Industry at Beltsville, Md. (Mature-age record, 21,516.1 pounds of milk and 727.4 pounds of butterfat.)



Age 1 Month
Weight 77 Pounds



Age 3 Months
Weight 155 Pounds



Age 6 Months
Weight 305 Pounds



Age 9 Months
Weight 394 Pounds



Age 1 Year
Weight 531 Pounds



Age 1 Year 6 Months
Weight 717 Pounds



Age 2 Years 1 Month
Weight 914 Pounds



Age 5 Years 10 Months
Weight 1,215 Pounds

FIGURE 11.—Pictorial record of growth of a Jersey female at the ages stated, in the experimental breeding herd of the Bureau of Dairy Industry at Beltsville, Md. (Mature-age record, 12,903.0 pounds of milk and 763.99 pounds of butterfat.)

by this method of feeding in the experimental breeding herd at Beltsville are shown in figures 10 and 11. The Jersey heifer is larger than the average of the Beltsville Jersey heifers as shown in table 2.

Of the three groups of Holstein heifers, two showed very little difference in the average body weight at 2 years of age, while the third averaged somewhat less in weight. The Holstein heifers at Ardmore weighed on an average 43 pounds more at 6 months, 37 pounds less at 1 year, 88 pounds less at 18 months, and 83 pounds less at 2 years of age, than the Holsteins at Beltsville. The Holstein heifers at Huntley, as compared with those at Beltsville, weighed 65 pounds more at 6 months, 88 pounds more at 9 months, 94 pounds more at 12 months, 61 pounds more at 18 months, and 14 pounds more at 2 years of age. The alfalfa hay fed to the heifers at Huntley was probably of higher average quality than the hay fed to the heifers at Ardmore and Beltsville.

QUANTITIES OF FEED CONSUMED BY DAIRY HEIFERS FROM BIRTH TO 2 YEARS OF AGE

In an experiment at Beltsville to determine the feed requirements of growing dairy heifers, 5 Holstein and 5 Jersey heifers were fed from birth to 2 years of age similarly to the other heifers at Beltsville, except that they received no pasture. These 10 heifers were so fed that they would gain rapidly but would not be excessively fat. They were raised without pasture because an accurate record could then be made of all the feed that they consumed. Their average body weights at 2 years of age were about the same as the averages for the other Holstein and Jersey heifers at Beltsville given in table 2. The monthly body weights, different ages, and total feed consumption to 2 years of age, are shown in table 3.

When available, good pasture could be used to replace all the roughage for heifers from 6 to 12 months of age, and to replace both roughage and grain for heifers over 1 year of age. When pastures begin to get short, heifers will require grain and later on some roughage also, to keep them gaining as rapidly as the heifers in this experiment.

TABLE 3.—*Feed consumed and gains made by Holstein and Jersey heifers from birth to 2 years of age*¹

[Average of 5 heifers each]

Year and 30-day period	Holstein						Jersey					
	Whole milk	Skim milk	Grain	Alfalfa hay	Corn silage	Weight at end of month or period	Whole milk	Skim milk	Grain	Alfalfa hay	Corn silage	Weight at end of month or period
First year:	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
At birth.....	223.0	20.8	1.7	1.9	1.5	103	197.6	44.6	0.5	0.8	0.4	54
1.....	16.7	324.5	20.5	19.3	23.8	151	1.5	286.0	7.6	10.3	8.6	95
2.....	0.0	402.2	53.9	36.0	71.6	197	0.0	344.7	28.4	24.6	32.6	127
3.....		402.2	76.2	55.8	118.4	251		343.8	56.9	39.0	75.0	166
4.....		402.2	87.4	70.1	180.6	308		344.7	75.9	61.1	116.6	211
5.....		399.5	87.9	70.4	234.5	363		344.7	86.5	75.2	169.4	256
6.....		0.0	89.1	79.7	334.0	408		1.1	89.1	80.3	271.3	300
7.....			89.1	87.0	418.5	450		0.0	88.9	84.1	353.6	336
8.....			89.1	89.6	455.9	496			89.1	87.3	390.3	375
9.....			93.9	89.6	517.2	545			89.1	87.4	427.4	406
10.....			94.8	97.0	576.8	582			89.1	88.7	460.4	436
11.....			92.7	110.6	615.0	624			89.0	88.0	483.6	468
12.....			15.5	18.5	105.5				14.9	14.6	83.3	
Last 5 days only.....												
Total.....	239.7	1,951.4	891.8	825.5	3,653.3	624	199.1	1,709.6	805.0	741.4	2,872.5	468
Second year:												
13.....			120.0	136.8	516.2	656			88.3	97.4	298.3	490
14.....			111.9	135.1	565.1	695			89.1	112.4	301.9	516
15.....			106.9	136.6	606.5	735			89.1	115.2	330.6	532
16.....			106.9	142.8	601.4	771			89.1	119.2	364.7	568
17.....			106.2	149.6	621.6	797			88.9	116.0	423.6	586
18.....			106.9	148.8	673.9	829			89.1	119.0	457.4	606
19.....			106.9	148.6	697.2	866			89.1	118.6	502.0	625
20.....			101.0	144.0	680.9	898			89.1	118.2	520.4	645
21.....			95.0	148.8	717.6	933			89.1	118.2	534.2	672
22.....			95.0	148.2	759.0	977			89.1	118.6	540.8	699
23.....			95.0	136.6	745.0	1,019			89.1	119.6	565.0	728
24.....			93.5	143.2	735.4	1,069			88.9	119.0	553.4	752
Last 5 days only.....			14.9	24.8	123.0				14.9	20.0	87.0	
Total.....			1,260.1	1,743.9	8,042.8	1,069			1,082.9	1,411.4	5,479.3	752
Total.....	239.7	1,951.4	2,151.9	2,569.4	11,696.1	1,069	199.1	1,709.6	1,887.9	2,152.8	8,351.8	752

¹ From unpublished reports of experiments by H. T. Converse, on the feed requirements for growth in dairy cattle.

QUARTERS

When the heifer is not on pasture she requires dry, well-bedded, well-ventilated quarters, and a suitable place to exercise. These can be provided by a pen in a barn, or an outside shed open to the south, with access to a yard that is large enough to allow her to take plenty of exercise. Feed mangers and boxes should be kept clean and sanitary. As far as practicable, heifers of about the same age should be kept together and separate from those older or younger. On farms where large numbers of young stock are raised, the calves and heifers are often housed in a barn built especially for that purpose.

AGE FOR BREEDING

The age to breed depends on the growth and development of the heifer. Since she will not yield any income until she has freshened, she should be fed liberally in order that she may be bred to freshen at 2 years of age or soon thereafter. As the calf is carried about 280 days, the well-grown heifer should be bred when 15 to 18 months old. At Beltsville good results have been obtained by having well-grown

Jersey and Holstein heifers freshen soon after 2 years of age. If the heifer is not undersized, nothing is gained by breeding for freshening at a later date. The breeding of heifers that have not made good growth, however, should be delayed somewhat, since too early calving under such conditions may result in smaller than average cows at maturity.

HANDLING THE HEIFER

Kindness in the care of the heifer will make her easier to handle when she enters the milking herd. Teach her to lead at an early age. Stall or house her with the milking herd a month or so before she is due to freshen. If possible, give her the stall she is to occupy after calving. Handle her daily during this period, in a quiet, gentle manner that will gain her confidence. After freshening, milk her carefully and quietly so that she will not get excited. The development of a nervous condition at this time may cause the heifer to form the habit of kicking or holding up her milk.

FEEDING AND MANAGEMENT OF THE YOUNG BULL

The feeding and management of bull calves being raised for breeding purposes is at the start much the same as that for heifers. Bull calves are usually a little larger at birth than heifers and usually grow a little faster.

After young bulls have reached 4 months of age they should be kept separately from young heifers.

Further information with regard to the feeding and management of dairy bulls is contained in Farmers' Bulletin 1412, Care and Management of Dairy Bulls.

FEEDING DAIRY CALVES FOR VEAL

Dairy calves not raised for breeding purposes are sometimes marketed as veal. Calves fed for veal are usually marketed between 3 weeks and 3 months of age, the majority being sold between 4 and 8 weeks of age. Detailed information on classes of veal calves is given in Department of Agriculture Circular 28, Market Classes and Grades of Calves and Vealers. Vealers weighing 110 pounds or less are classified as lightweight, those weighing from 110 to 180 pounds as medium weight, and those weighing over 180 pounds as heavy-weight. Each weight division is further classified into several grades on the basis of conformation, finish or degree and smoothness of fleshing and fat, and quality of the meat. When properly finished, the calf that is blocky and compact in conformation will dress out a larger percentage of the high-priced cuts than the calf that is angular and rangy. Consequently it commands a higher market price. Vealers of medium weight usually bring a higher price than either lightweight or heavyweight vealers.

Whole-milk feeding produces the best grade of veal. Where the calf receives grain and hay in addition, these should be fed in very limited amounts. Approximately 10 pounds of whole milk is required to produce 1 pound of gain in live weight. In feeding calves for veal, during the first week give about 7 pounds of whole milk per day to the 60- to 70-pound calf, 8 pounds to the 70- to 80-pound calf, 9 pounds to the 80- to 90-pound calf, and 10 pounds to the 90- to 100-pound calf. After the calf is a week old, increase the quantity of whole

milk gradually until a good-sized, vigorous calf is receiving from 16 to 20 pounds or more per day before it is marketed. Calves will fatten more rapidly if fed three times daily and confined so that they get little exercise.

Unless veal is high in price as compared to milk, the value of 10 pounds of whole milk will usually exceed the value of the 1 pound of gain that it produces. Any profit to be made will come, therefore, not from the gain in weight but from the value of the initial or birth weight of the calf. For this reason, profits can only be expected from the feeding for veal of the calf that is large at birth and blocky and compact in conformation. The calf should be fed until it attains a high state of flesh, as thin or inferior calves will not bring a good market price. On the other hand, the calf should be marketed as soon as it reaches the proper condition, since the continued feeding of whole milk will not increase the selling price per pound and will lessen the profit to be made from it.

PREVENTING HORNS

The development of horns can be easily prevented by the use of caustic soda or caustic potash. This material is usually used in the stick form, which is procurable in most drug stores or from dairy-supply houses. Caustic paste is also suitable for this purpose, and is a little easier to apply than stick caustic.

The best time to apply caustic is when the calf is from 4 to 10 days old. At this age the undeveloped horn or button is not attached to the skull and appears more as part of the skin. Growing horns can also be successfully treated with caustic up to the age of 2 or 3 months. The horns of older calves require more caustic, and are more bother to treat.

Before applying the caustic, clip off the hair from around the horn buttons, and apply vaseline to the surrounding area to prevent the caustic accidentally coming in contact with it and causing severe burns.

To apply stick caustic, wrap the stick in paper with one end exposed, or slip it part way into a small rubber tube. Slightly moisten the exposed end with water and rub each horn button alternately, making a raw spot about the size of a nickel. Do not continue rubbing until these spots bleed; merely take the outer skin off of the horn buttons. In treating growing horns, do not treat the tip but make a raw ring completely around the base of the horn where it joins the skin, by rubbing with the stick of caustic. The horn grows from the skin at its base, and destroying this tissue will stop the development of the horn. Do not cut off the horn with a knife, as this causes bleeding which will wash off the caustic. In applying the caustic, use only a minimum of water so that the caustic will not run down the calf's head. The method of applying stick caustic to prevent the growth of horns is illustrated in figure 12.

When using caustic paste, clip only the hair immediately over the horns as the surrounding hair will help to hold the paste in place. Spread a quantity about the size and thickness of a nickel on each horn button. In treating growing horns make a raw ring around the base of the horn where it joins the skin, by rubbing with sandpaper or an ordinary file, but do not draw blood. Then apply the caustic paste to this ring, using a little more than for younger calves. Caustic paste is irritating in action, and the calf will attempt to rub it off, or

scratch it off with a hind foot. To prevent this, confine the calf in a close-fitting stanchion during the operation and for a half hour afterwards. If the stanchion does not fit the neck closely the calf is likely to pull back until its ears touch the caustic applied to the buttons, thus causing severe burns.

After treating the horns with caustic, protect the calf from rain for a day or so.

Caustic absorbs moisture from the air and deteriorates rapidly when kept in an open container. When not in use it should be kept in a small glass jar or bottle tightly closed by a rubber stopper.



FIGURE 12.—Applying stick caustic to prevent the growth of horns.

MARKING CALVES FOR IDENTIFICATION

It is important, especially in registered herds, that each calf be marked plainly for easy identification. This is best accomplished by using metallic or composition ear tags or by tattooing the ears. Breeding and calving records, photographs, and diagrams of color markings are also helpful.

Fiber-disk ear tags used for identification are fastened to the thick upper part of the ear by means of a hog ring that pierces the ear (fig. 13).

Tattooing the ear is a simple operation (fig. 14), and insures a permanent method of identification when properly done. It is accomplished by (1) thoroughly washing the dirt and wax out of the inside of the ear with either alcohol or gasoline, and then drying the ear; (2) a series of letters and numbers composed of needle points mounted on blocks are placed in a tattoo marker, the needle points are covered with tattoo ink and they are pressed deep into the central part of the inside of the ear that is free from hair; (3) the tattoo ink or oil is then thoroughly rubbed into these perforations with the finger tips. Black tattoo ink is used for ears with light-colored skin, but is not satisfactory for ears with dark-colored skin. Red ink is sometimes used for ears with dark-colored skin, but is hard to read and not very satisfactory.

REMOVING SUPERNUMERARY TEATS

Often the udder of dairy heifers has extra or supernumerary teats, in addition to the four normal teats. Although such teats do the heifer no harm, they may be unsightly when she matures and may

make milking more difficult. In some cases an extra teat may secrete milk, and in that event may cause considerable bother by leaking at milking time.

Extra teats can be easily removed up to 1 year of age. Stretch out the teats and cut off close to the udder with a sharp pair of scissors. Apply iodine or some other good disinfectant both before and after the operation. In some cases in older animals it may be necessary



FIGURE 13.—Fiber-composition ear tag with number for identification.

to dissect out the teat and its accompanying gland. This should be done only by a person skilled in veterinary surgery.

PURGATIVES AND ENEMAS

Olive oil makes the best purgative for very young calves, but is more expensive than other purgatives. Mix 4 to 6 ounces of olive oil with 1 pint of warm milk. Give this to the calf from a long narrow-necked bottle either with or without a nipple. Take care to hold the bottle so that the liquid runs out slowly, or some of it may get into the lungs. Mineral oil may be used in place of olive oil.

Castor oil is a good purgative, but has a stronger action than olive oil, and may be too irritating for very young calves.

The usual dose is 1 to 3 ounces, given in the same manner as olive oil.

Epsom salts makes a suitable purgative after the sixth month of age. One fourth of a pound will be enough for a 6-month-old calf, and



FIGURE 14.—Number tattooed in heifer's ear for identification.

one half pound or more may be used for older animals, depending on their size. Mix with a pint or more of warm water and give from a long narrow-necked bottle.

A physiological salt solution makes the best enema for calves. Do not use any other material as an enema except on the advice of a veterinarian. To make this solution, heat water to a temperature of 110° F. and add 1 heaping teaspoonful of common table salt to each quart of water to be used. Two quarts of this solution will be sufficient for most calves. Administer the solution by gravity through the rectum of the calf, using either a tube and funnel or an ordinary fountain syringe.

COMMON AILMENTS OF CALVES

Calves are susceptible to various ailments, some of which are unknown in older animals. They consist principally of digestive disturbances, lung troubles, and parasites. Most of these ailments can be prevented by keeping the calf in clean, well-ventilated surroundings and by proper feeding and care.

WHITE SCOURS

White scours is a specific and highly contagious disease of calves which shows itself at birth or shortly after birth. The infection usually takes place through the navel cord but may occur through the digestive system. Soiled bedding in the pen, soiled udder and teats, or sick calves in nearby pens with open partitions are possible sources of infection.

A calf affected by this disease wants to sleep all the time and cannot be induced to eat. There is a profuse discharge of yellowish-white droppings with a highly offensive odor. The disease is nearly always fatal and the calf dies within 3 or 4 days.

Preventive measures are the best cure for white scours. Have the cow calve in an isolated and thoroughly cleaned and disinfected maternity pen, care for the calf as outlined under the heading Care of the New-born Calf, and keep it isolated until all danger of the disease is past.

In case of an outbreak of contagious scours destroy the carcasses of all dead calves; remove the infected bedding and other material from the pens and destroy or spread at once on cultivated fields; thoroughly disinfect the pens and all tools and equipment used around the pens. If these measures do not prove effective, consult a veterinarian.

CONSTIPATION

When the calf is born there exists in the posterior bowel a greenish-black mass, known as "meconium." The meconium should be expelled within 12 hours. If it is not expelled, the bowel remains inactive. This condition lowers the calf's resistance to infections that may cause its death in a short time.

If the calf receives a normal quantity of the first milk or colostrum, which is purgative in nature, the meconium is usually expelled within a short time. In the few instances where the meconium is retained, its removal can be effected and the bowels started to functioning normally by a physiological salt solution used as an enema.

Constipation of older calves from other causes can be corrected by the use of a suitable purgative.

SCOURS FROM INDIGESTION

Indigestion followed by scours may be caused by overfeeding, irregular feeding, use of unclean utensils, feeding cold milk, too rapid changes in feed, cold drafts, and cold, damp floors. It is caused in most cases by overfeeding, which distends the stomach, and which in turn retards or stops the flow of gastric juices. When this happens the feed is not properly digested, the calf is weakened, resistance is lowered, and infections may gain a foothold.

The products of decomposing feed are absorbed by the body, and the calf becomes listless and dull 24 hours before any other symptoms appear. The calf may also be constipated before the scouring starts. The droppings become pasty or liquid in consistency but are not usually as light in color or as offensive in odor as in the case of white scours. In severe cases the droppings may get lighter in color, more offensive in odor, and blood may sometimes be present.

If it is noted that the calf is listless, reduce the quantity of feed and give a suitable purgative. This will check the indigestion before scouring starts, and the calf will soon be back to normal.

Where the calf has started scouring, reduce its feed by one half and give a suitable purgative. Repeat the dose in a day or two if necessary. An enema of physiological salt solution will also be helpful in clearing the infection out of the bowels.

Blood in the droppings is sometimes an indication of a disease caused by a protozoan organism. Where such a condition persists, a veterinarian should be employed to make a diagnosis and give instructions for ridding the farm of the disease.

PNEUMONIA

Congestion of the lungs, followed by pneumonia, occurs in many calves that have had indigestion and scours, especially when not properly taken care of in the early stages. The prompt treatment of scours will therefore lessen the danger of pneumonia.

Calves also get congestion of the lungs and pneumonia when exposed to sudden changes of temperature, and especially in windy weather when doors or windows are accidentally left open or are blown open. The cold draft passing over the calf takes heat from its small body, bringing on a chill.

A calf with pneumonia usually lacks an appetite, breathes rapidly, is constipated and runs a temperature as high as 105° or 106° F. Severe cases are usually fatal.

Blanket the sick calf and place it in a dry well-bedded pen at a comfortable, even temperature and away from all drafts. Give it moderate quantities of feed. Use a purgative if necessary to avoid constipation. Massage or rub the calf all over vigorously several times a day. If the animal is valuable, consult a veterinarian for further treatment.

LUNG PARASITES

In some localities, the lungs of calves become infested with parasites. When this occurs, it is best to have a veterinarian prescribe the proper treatment.

RINGWORM

Ringworm is a fungous growth characterized by circular or ringlike areas which are scabby and practically free from hair, and increase in size as the infection spreads. This ailment is most troublesome in

winter when calves are closely housed. The infected areas itch, are very irritating, and give the calf an unsightly appearance. Ringworm spreads rapidly, but can be checked by thoroughly cleaning and disinfecting the calf pens, and applying salicylic ointment or a good coal-tar or iodine ointment to the infected spots. Rub the ointment in thoroughly once each day until there is a considerable improvement, and then twice each week until the infection has disappeared. Do not miss any infected spots, and be sure to cover the entire surface of each affected area. Keep the pens clean so that reinfection will not occur.

WARTS

Warts are of common occurrence on calves and heifers, particularly during summer and autumn. They may occur in the skin of the head, neck, or other parts of the body. They are infectious or catching, and may spread over the body or to other animals unless steps are taken to check them. The daily application of castor oil is beneficial, and should be made when the warts are first noted and are still small. In many cases the castor oil softens the warts to the extent that they are rubbed off by the animal's movements. If this does not remove the warts, tie a silk thread tightly around the wart near the base and allow the thread to remain until the wart drops off. Animals badly infected with warts should be isolated from the rest of the herd and the exposed stables and pens disinfected. Further information on the treatment and prevention of warts is contained in U.S. Department of Agriculture Leaflet 75, Warts on Cattle.

LICE

Calves kept in clean quarters and given a thorough, vigorous brushing every day, are less likely to be infested with lice and other parasites of the skin. Lice may become quite numerous on the calf before they are detected. They are very irritating, give the calf an unthrifty appearance, and when present in considerable numbers, keep it from gaining as it should. Lice usually are not very bothersome in the spring or summer, but increase in numbers rapidly during the winter, when the calves are closely housed. In warm weather the lice can be killed by sponging or spraying the calf thoroughly with various commercial lime-sulphur, coal-tar, or nicotine dips according to the directions given on the container. Sponging or spraying usually is not advisable in cold weather, because of the danger of chilling and pneumonia. The best plan for keeping down the lice in winter is to brush the calf frequently and dust the infested parts as often as necessary with powdered borax or pyrethrum powder. In a half hour brush off any surplus pyrethrum powder so that the calves will not get any in their mouths by licking.

FLIES

Flies are particularly bothersome to young calves, especially during hot weather. The calf's skin is thin and tender, the flies are very irritating, and the calf is unable to fight them away.

Protect the new-born calf from flies by darkening the pen, and by spraying the flies on the walls and ceiling with an effective fly spray, preferably one containing kerosene and pyrethrum. Apply this in such a manner that it will be effective in killing the flies, and will not be sprayed on the calf. If the fly spray is rubbed on the calf's skin, it will cause blisters followed by severe sores.

Calf manure provides an ideal place for flies to breed. The calf pens should be thoroughly cleaned out every few days and the manure scattered so that the larvae will not develop. Throwing it in a pile will not prevent the larvae from maturing.

LEAD OR PAINT POISONING

Calves and heifers will eat paint from the walls of their pen or from any painted object or receptacle they can reach. Paint containing lead is poisonous, and if it is consumed in any appreciable quantity the animal usually dies.

This trouble can be prevented by whitewashing the walls or by using paint that does not contain any lead. Care should also be taken to keep all tools, implements, and utensils used in painting, away from cattle. Paint buckets especially should not be allowed around barns, lots, or pastures.

Billboards painted with lead paint are a source of lead poisoning, and are particularly dangerous when freshly painted. Billboards should not be erected in pastures or other places where cattle are kept unless an adequate fence is built to keep the cattle away.

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